

**INDUSTRIAL WASTE
DIVERSION PROGRAM
FINAL REPORT --**

**Wood Waste and
Corrugated Cardboard Waste
Diversion Project**

APRIL 1993



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FINAL REPORT --
WOOD WASTE AND CORRUGATED CARDBOARD WASTE
DIVERSION PROJECT**

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in affiliation with

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Ontario Ministry of Environment and Energy

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**Final Report
Wood Waste and Corrugated Waste
Diversion Project**

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Abstract

Diversion of Industrial Wood and Old Corrugated Cardboard Project

Niagara Waste Systems Limited Recycling Plant

The objective of this project was to divert recyclable wood and old corrugated cardboard (OCC) from industrial wastes currently landfilled at Niagara Waste Systems' landfill in Niagara Falls, Ontario. An unused structure adjacent to the landfill was converted to a recycling plant, in which was installed a wood hoggerizer and a baler. Old pallets and other non-painted and non-treated wood products were shredded to produce animal bedding and garden mulch. Source separated OCC and OCC from mixed wastes were baled and sold to local converters.

The plant commenced operation in March 1991. Between March 1991 and June 1992, a total of 1244 tonnes of recyclable material was recovered. All recovered material was sold although market prices were low. Due to the success of the project, the facility will continue in operation beyond the end of the project. Operating and marketing experience gained from the project will be used as a basis for the design of a large scale IC & I recycling facility.

A. Introduction

In the winter of 1991, Niagara Waste Systems Limited (NWSL) converted a building, formerly used for the production of cut stone into a recycling plant for the diversion of recyclable industrial and commercial waste. The plant is located in the west side of Townline Road, Thorold. NWSL operate a non-hazardous landfill site on adjacent property. Much of the waste that is received at the landfill is from industrial and commercial sources and contained potentially recyclable materials.

The object of this project was to divert from the landfill recyclable materials, primarily wood and cardboard. The second objective was to , on a full pilot scale basis, operate a processing facility for wood and cardboard material diverted from landfill and develop markets for these materials. The operational and financial information gained from this project will be used as a basis for the design and operation of a larger facility to recover recyclable industrial/commercial and institutional (IC & I) wastes.

Conversion work at the former cut stone structure included enclosing the steel framework of the structure with siding and the installation of a wood hoggerizer and a baler. A forklift was also purchased for the handling of baled cardboard and pallets. The recycling plant commenced operation in March 1991.

Initially the plant received 'clean' loads of old corrugated cardboard (OCC) and wood pallets. In the spring of 1992 source material types were expanded to also include mixed loads of industrial and commercial waste rich in OCC and wood. Scrap metal recovery was also added to the plant's operation.

Previous audits and observations of wastes landfilled identified approximately 17,000 tonnes of waste wood and 5,000 tonnes of OCC which could potentially be recycled.

On September 18, 1990, NWSL submitted an application for funding under the Ministry of the Environment's Industrial Waste Diversion Program. This application was for a grant towards the cost to purchase and install a wood grinder to shred old wood pallets to produce animal bedding and garden mulch; to purchase and install a baler to bale old corrugated cardboard (OCC) and other waste paper fibre materials for recycling and to purchase a forklift to handle old pallets and baled materials.

In a letter dated September 25, 1991, NWSL was advised that their application for funding had been approved. The Ministry had established that eligible capital costs were \$459,308. Funding was approved at 20% of eligible capital costs to a maximum of \$91,862. (Refer to Appendixes B and C)

The Project

B. Implementation

The project was implemented with the selection of appropriate equipment to process recyclable wood and OCC wastes.

B.(1) Wood Waste

Markets for diverted wood waste include garden mulch and animal bedding. The source material identified to best provide suitable wood for processing was from old pallets and unpainted and untreated soft and hard woods. Old pallets also take up a lot of space when landfilled, thus they are an ideal material to be diverted from the landfill.

Equipment chosen and subsequently purchased to process the old pallets was a Schutte Model #56-35 wood hogger. The system purchased included a 16' vibrating in-feed conveyor 250 horse power shredder drive motor, two stage magnetic nail recovery and fan powered pneumatic system to load receiving trailers for shipment to markets. The hogger, exclusive of installation, cost \$136,059.

B.(2) Old Corrugated Cardboard (OCC)

Initially clean, pre-sorted OCC waste was anticipated to be received for final sorting and baling. Suitable OCC material was to be sourced by Woodington Systems Limited, a sister company of NWSL.

Equipment chosen to bale the cardboard was a used EC Baling System, Model No. EC6 T SM baler. This system included a 10' feed conveyor, pre-shredder and single stage baler. This baler can produce bales of 5 different sizes. The baler equipment, exclusive of installation, cost \$123,031.

B.(3) Forklift

A forklift was required both to load the old pallets onto the hoggerizer's vibrating conveyor and to store and load bales of OCC. A Komatsu Model F025 was chosen. The forklift cost \$31,644. The forklift's pneumatic tires were replaced with solid tires during the project.

B.(4) Installation

Work associated with the installation of the hoggerizer and baler included provision of transformer and other electrical work, lighting, and installation of heat lamps for winter work. New concrete floors were poured around the equipment. Total costs associated with installation of equipment was \$168,574.

B.(5) Operations

All waste to be accepted at the recycling plant was first weighed in at the landfill's weigh scale. Suitable loads of waste for the recycling plant were either pre-arranged for acceptance, usually clean loads of wood and OCC, or in the case of mixed waste was directed by the weight scale clerk to the recycling plant. Mixed waste loads were accepted subject to available room on the recycling plant's tipping floor.

Clean loads of OCC and mixed loads of waste rich in OCC are received at the north end of the plant, where the baler is located. A moveable concrete barrier, approximately 0.8 m high was installed to separate clean OCC loads from mixed waste loads. Clean loads are disposed to the right of the barrier, directly in front of the baler's feed conveyor. Mixed waste is dumped on the left of the barrier.

Mixed waste is hand sorted. OCC suitable for recovery was thrown over the barrier, where it was pushed, along with OCC received in clean loads onto the feed conveyor. Usually OCC and mixed waste were delivered in compacted loads. The forklift was used to fluff the OCC prior to being pushed onto the feed conveyor. Mixed loads of waste were broken up using a bobcat style small front end loader. The loader's bucket had been equipped with two grapple claws to facilitate the handling of OCC and other waste materials.

During the sorting of mixed wastes, wood suitable for shredding and scrap metal was also sorted out. The scrap metal was loaded into a 20 cu.yd. roll-off bin located adjacent to the baler.

Clean and mixed loads of wood were accepted at the south end of the plant. Wood waste was dumped on the floor. Pallets were loaded onto the hoggerizer's vibrating conveyor using the forklift. Other suitable wood material was loaded by hand onto the conveyors. Oversized pallets were cut with an electric chainsaw prior to feeding into the hoggerizer.

Non-recyclable material was loaded into 40 cu.yd. lugger boxes which were hauled on a regular basis to the adjacent landfill for disposal.

All material including non-recyclable material hauled to disposal was weighed out at the landfill's weigh scale in order to calculate diversion rates.

Initially 2 staff were employed at the plant. This staff would either work on the processing of clean OCC or wood pallets. With the introduction of mixed waste to the facility, staffing was increased to (4) four. This allowed for both OCC baling and operation of the wood hoggerizer at the same time. Alternatively all (4) four staff would be engaged in the sorting of mixed waste to recover recyclable OCC.

Staff alternated between operating the forklift and bob-cat loader and hand sorting as the operation demanded.

C. Quantities of Material Diverted
March 1992 thru June 1992

Old Corrugated Cardboard	867 tonnes
Wood	371 tonnes
Scrap Metal	6 tonnes
	<hr/>
Total Waste Material Diverted	1244 tonnes

Please refer to Appendix A for a monthly breakdown of quantities diverted.

D. Markets

(1) Sources

Initially the facility was proposed to accept only 'clean' loads of OCC and wood. To encourage delivery of clean material to the recycling plant the disposal fees of \$40 per tonne for OCC and \$55 per tonne for wood were established. (The landfill disposal fee in 1991 was \$85 per tonne)

However this 'discounted' disposal fee did not seem to be sufficient incentive for generators to source separate these materials. Further much of the 'clean' material still contained contaminants which had to be sorted out by hand. Consequently the recycling plant was operating below capacity, normally receiving less than 5 tonnes per day. Estimated capacity for clean material was 10 tonnes per shift.

In the spring of 1992 it was decided to accept mixed waste loads which contained at least 50% OCC or wood suitable for diversion. The fee charged for disposal for mixed waste was established at \$95 per tonne, the same disposal fee charged for landfilled waste.

Also to increase the amount of wood recovered, along with pallets clean lumber, primarily for packing crates and other industrial uses was also processed through the hoggerizer.

Suitable loads of mixed waste were identified either at the landfill's weigh scale or inspection station or by generator. For instance, it was found that mixed waste from General Motors Plant #2 generally contained a large percentage of OCC and wood. Unsorted waste from a number of department stores were also found to contain a large percentage of OCC and scrap metal.

With the addition of selected mixed wastes, incoming material quantities increased to an average of 16 tonnes per day. Mixed waste yielded a minimum 50% recyclable material. Including 'clean' material 70% to 75% of all incoming material was diverted.

The following companies were primary sources of material for the recycling plant.

Canadian Oxy	Bazaar Novelty	Page Hersey
Aimco	BF Goodrich	Unity Trim
Brower Construction	John Deere	Young's Lumber
Canadian Tire	Niagara Caterers	Ford of Canada
General Motors	IGA	Board of Education

Waste haulers delivering material to the facility included:

Woodington Systems
Waste Management Niagara
Active Waste Disposal
Laidlaw Waste Systems
Universal Environmental Services

D. (2) End Markets

(i) Wood

Recovered OCC and wood materials were sold locally. Shredded wood was sold for animal bedding and garden mulch. The material was sold to a local wholesaler, Sundance Farms of St. Catharines.

Sundance provided a trailer which was directly loaded from the hoggerizer. Shredded wood was blown into the trailer after passing through the two-stage magnetic separator. Each trailer load of 25 to 30 cu.m. weighted an average of 6 tonnes. The low weight to volume ratio 210 to 225 kg per cu.m., reflects the very dry condition of the waste wood being processed.

Average revenues for shredded wood ranged from \$15 to \$18 per tonne picked up.

(ii) OCC

Baled OCC was sold to either Northern Globe Material who manufactures roofing paper or Beaverwood for the production of corrugated packaging materials. Baled material was hauled by 'walking floor' trailer. Bales were loaded on the back of the trailer using a forklift. The bales were then 'walked' to the front of the trailer. Movement of the walking floor was reversed to off load the bales. This type of trailer was used as the recycling plant did not have a trailer height loading dock or yard ramp.

Average revenues for OCC were \$20 per tonne delivered.

(iii) Scrap Metal

Since the spring of 1992 only a few loads of scrap metal have been shipped to market. The market grade is mixed scrap. The scrap metal was recovered by hand. Nails and other fasteners removed by the two-stage magnet separator at the hoggerizer are considered a higher grade, but quantities were generally limited. Scrap metal was delivered to Intermetco in Hamilton.

Revenues for scrap metal range from \$70 per tonne for mixed scrap to \$90 per tonne for nails and other scrap pallet fasteners.

E. Results and Conclusions

(1) Results

- . The project was successful in diverting recyclable waste from disposal. A total of 1244 tonnes of recyclable material from industrial and commercial waste was diverted from landfill between March 1991 and June 1992.
- . By accepting mixed loads of industrial and commercial waste (along with source separated material), the amount of material diverted was increased.
- . Revenues from the sale of recovered material did not cover the facility's costs. Disposal fees remain the prime source of revenues to cover operating costs.
- . Discounted disposal fees, even fees less than 50% of landfill disposal fees were not enough to persuade a significant number of waste generators to separate recyclable materials at source.
- . Once separated at source there are a number of local facilities for OCC and waste wood materials as opposed to none for mixed wastes containing OCC and wood waste.
- . Following processing, there were ample local, regional and provincial markets for OCC and shredded wood, notwithstanding the low revenues the sale of these materials received.
- . Adequate technology exists to process sorted waste materials. However the sorting of these materials from mixed waste, prior to processing either at the generator or recycling plant requires a great deal of manual sorting.

(2) Conclusion

As a result of this project, the following conclusions can be made:

- . A substantial portion of industrial wastes currently being landfilled in the Niagara area can be diverted from disposal and sold as recyclable material.
- . Markets exist for recyclable OCC, shredded wood and scrap metal, although market revenues remain well below the costs incurred to separate and process these materials.
- . Notwithstanding significant pricing incentives many industrial waste generators are not willing to source separate their recyclable materials.
- . There is a need for recycling facilities that will sort through mixed industrial and commercial wastes to recover recyclable materials and there are ready markets for these materials once suitably processed.
- . Significant 'disposal' fees will have to be charged by recycling facilities to make such facilities economically viable unless there is a substantial increase in market prices for recyclable materials.
- . Hand sorting remains the most effective way of sorting mixed industrial wastes and also to remove contaminants from source separated materials. Once sorted there are a number of mechanical systems available to process 'clean' industrial waste materials.

ACKNOWLEDGEMENT

We wish to thank the staff of the Ministry of the Environment's Industrial Program Unit of the Waste Management Branch for their assistance and funding for this project. We also wish to thank staff of the Ministry's West Central Region and Welland District Office for their guidance in development and operation of Niagara Waste Systems Limited's recycling plant. The support of the Region of Niagara is also gratefully acknowledge.

APPENDIX "A"

NWSL Recycling Plant Recyclable Material Sales March 1991 thru June 1992 (tonnes)

<u>Month</u>	<u>OCC</u>	<u>Wood</u>	<u>Scrap Metal</u>
March/91	----	----	
April	29.4	32.5	
May	----	52.0	
June	20.8	13.0	
July	12.0	----	
August	52.2	6.5	
September	45.8	----	
October	47.6	6.5	
November	50.2	29.0	
December	73.8	30.0	
January/92	84.6	28.0	
February	52.0	30.0	
March	87.2	26.0	
April	83.8	26.0	
May	114.2	45.2	2.0
June	<u>113.1</u>	<u>45.5</u>	<u>4.0</u>
Total	866.7	370.5	6.0

